

PROJECT SUMMARY

Title: Development of Enhanced, Web-based New York and New England Tree Fruit Pest Management Guidelines

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Institution: Cornell University

Co-PD: Cooley, Daniel

Institution: University of Massachusetts

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Institution: University of Massachusetts

Project type: Extension

This is an Extension project. Cornell's Pest Management Guidelines for Tree Fruit Production have traditionally been a primary information source for producers. Printed guidelines cannot deliver IPM information in "real time" during the season. Web-based IPM sites that have access to weather data can provide pest development forecasts so that pest populations can be sampled and monitored at appropriate times and insure that pesticide applications and other control tactics are properly timed. Websites can also help growers choose the most appropriate pesticide when necessary. Most of this information is currently available on various Cornell websites or in the printed guidelines, but it is scattered among different sources. This project will integrate all of this information into a single user-friendly website. Users will be able to access pest forecast models linked to weather conditions at particular sites that will predict when sampling and monitoring is necessary and provide information about different management tactics. When pesticides are recommended, the site will provide a link to a pesticide decision table which includes the following categories of information to help users choose the most appropriate material: Common name, trade name, rate, Re-entry interval, Pre-harvest interval, Efficacy against various pests, bee toxicity, effects on natural enemies, cost/acre, general comments and use restrictions.

Project Narrative

a. Problem, Background and Justification

The preparation of pest management guidelines and recommendations for various commodities has traditionally been an important activity of land grant universities. For many years this information has been extensively utilized by extension agents, growers, and other agricultural stakeholders throughout the United States. Originally, these guidelines were primarily based on using pesticides to solve pest control problems. Therefore, the preparation of these guidelines was a collaborative project between researchers conducting efficacy trials for various pesticides and extension personnel using this information to develop a set of pesticide recommendations based on some set of criteria. The general philosophy of pest control has changed dramatically with a modern emphasis on utilizing the principles of integrated pest management to control the pest complex in an agricultural landscape. Growers are advised to use sampling and monitoring systems based on research-defined economic injury levels whenever possible to determine when and if pesticides should be applied and to integrate other tactics such as plant resistance, cultural controls, and biological controls into management systems. Consequently, guidelines have expanded to include all of this IPM information as well as crop management techniques, soil and plant nutrition, cultivar selection, and other important information that can be blended into an even more comprehensive system for integrated crop management. It is becoming increasingly difficult for Land Grant Universities such as Cornell to generate and deliver this information to the agricultural industry because fewer staff are being hired to conduct applied research and resources for extension personnel are diminishing each year. Legal and legislative restrictions on the use of chemicals are greater than ever. University budgets have been cut and Extension agents are being asked to do more with less. Producing pest management guidelines in this current environment of shrinking financial resources, increasing regulatory restrictions, and increasing consumer concern about safety of the food supply and the quality of the environment has been challenging and expensive for most Land Grant Universities and fewer and fewer guidelines are being produced. However, there is still a major need for such information in order to help growers throughout the United States use cost-effective IPM programs that are acceptable to concerned consumers, regulatory agencies, and that will preserve the quality of the environment.

It is also becoming increasingly difficult to deliver this information to agricultural stakeholders in the modern world who are increasingly utilizing digital information delivery systems. Traditionally, print publications were the primary mechanism to deliver information to extension personnel, growers and other stakeholders. Information is now available on the web, CDs, DVDs, tapes, databases, PDAs, as well as on other media. Bringing all this information together for an agricultural commodity in a specific area and then organizing information that can be utilized throughout an entire growing region is a huge challenge.

Printed guidelines are unable to deliver IPM information in “real time” during the season. Web-based IPM sites, such as the Network for Environment and Weather Awareness (NEWA) site (newa.nysaes.cornell.edu/public/default.htm) that have access to weather information for different production sites can provide pest development forecasts so that

populations can be sampled and monitored at appropriate times and insure that pesticide applications and other control tactics are timed according to seasonal pest development. Websites, such as the one for Cornell's Pest Management Education Program (PMEP), contain the written guidelines and can provide information for choosing pesticides based on efficacy against the target pest, other secondary pests, environmental effects, IPM considerations, and cost. Although most of this information is currently available on various Cornell websites or in the printed guidelines, it is difficult for users to integrate it into a comprehensive management system that can be used to make pest control decisions at appropriate times throughout the season. The solution to this problem is to build a semantic web of metadata that describes the attributes of the different types of content related to IPM and to customize this information to be relevant to regional needs.

During the last several years, the Extension program at Cornell has been actively involved in improving the development and production of printed Pest Management Guidelines for all major groups of commodities produced within the state. The NYS IPM program at Cornell originally led the effort to evaluate and develop these methods to improve the production and distribution of the Pest Management Guidelines and secured additional funding to facilitate this process. The PMEP staff reviewed information about pesticides listed in the guidelines to check the registration status of recommended pesticides on each commodity within the state prior to its publication. These printed guidelines were sold and distributed by Cornell's Media Services Group. However, this infrastructure did not receive adequate financial support and was unable to continue operation.

Therefore, in 2006, the overall responsibility for the preparation, distribution, and sales of the Guidelines was assigned to Cornell's PMEP. This program currently prepares, distributes, and markets an extensive set of Pesticide Training and Certification manuals to agricultural stakeholders in NY and throughout the Northeast. PMEP also maintains an extensive web site with information about pesticides, pesticide safety, and current labels for all materials registered in NY. Centralization of the Guidelines within this program will facilitate the continued integration of IPM information, pesticide education and training, current registration and pesticide labels, and allow stakeholders to obtain integrated information about IPM, crop production, and pesticides from a single source.

The PMEP office has continued to develop effective collaboration, content management and publishing options that began at Cornell several years ago. The current Cornell Guideline production system uses Microsoft Word documents in a collaborative (MS SharePoint) environment. This system, which allows authors to edit Word documents and upload them to a website for review, has greatly increased compliance and participation. Authors can even email their documents back to the designated web site and alert an editor to start the review process. SharePoint has evolved as has our approach to creating structured, relevant, publications. This new system, which is based on collection of digital content, provides a much higher level of author collaboration, stakeholder involvement, organization of information, and administrative review. This final collection of digital content can be easily used to generate products for print or web distribution.

Currently, the printed versions of all Cornell Guidelines are also available on websites that have varying types of information and formats. Some of the websites are simply displays of printed material, while others have other IPM information and links to other IPM decision-making information. In order to continue development of digital content of comprehensive information for web-based and printed IPM guidelines, tree fruit has been chosen as a model system. Tree fruit production throughout the Northeastern region is heavily focused on apples. Apples were originally designated as one of the commodities to receive federal funding to develop applied IPM systems in the early 1970's. This commodity group was selected because high levels of pesticides were applied and the complex of insect pests and diseases throughout the Northeast is particularly severe and extensive. Considerable progress has been made in developing new technology and recommendations for IPM on apples in NY and throughout the Northeast. Therefore, this commodity group can be used to develop the prototype for a more advanced system for integrating IPM and pesticide information distributed in printed or digital form to growers and other stakeholders. Recently, Tree Fruit Pest Management Guidelines have adopted a regional focus with cooperative efforts between New England Land Grant Universities and Cornell University. This effort began in 2005, when researchers and Extension personnel from New England decided not to prepare their own regional publication, but to purchase Guidelines from New York. The primary reason for their decision not to continue to prepare this regional material was a lack of adequate staff, funding, and infrastructure. In 2006, Cornell and the University of Massachusetts received a Partnership grant from the NEIPM center to develop regional printed Tree Fruit Pest Management Guidelines for New York and New England for the forthcoming 2007 growing season. Printed New England Tree Fruit IPM Guidelines were developed as a result of this grant and marketed to stakeholders within the region by cooperating Universities. Originally, this grant also proposed to develop an enhanced, web based version of these guidelines, but this work was not completed because of a budget reduction.

There is still considerable interest from stakeholders in the tree fruit industry throughout NY and New England in having web-based IPM sites that integrate the static information of the various printed guidelines with more dynamic information. Weather for different production sites, for example, can provide pest development forecasts so that populations can be sampled and monitored at appropriate times insuring that pesticide applications and other control tactics are timed according to seasonal pest development. These websites can also provide information for choosing pesticides based on efficacy against the target pest, other secondary pests, environmental effects, IPM considerations, and cost. Most of this information is currently available in the printed Tree Fruit Guidelines or on various Cornell websites (as PDF files). However, it is difficult for users to integrate the information into a comprehensive management system that they can use to make pest control decisions at appropriate times throughout the season. The objective of this project is to integrate all of this information in a dynamic and interactive Tree Fruit IPM Guidelines website that can easily be used by people in the apple industry throughout the northeastern United States.

b. Objectives and Anticipated Impacts

The objective of this project is to design a website for New York and New England Tree Fruit Pest Management Guidelines that will allow the industry to integrate pest development models, IPM tactics, and pesticide information together and with real-time weather and sampling information into a comprehensive management system that can be used to make better pest control decisions. The organization and design of web-based tree fruit information that can be customized according to regional needs will immediately impact stakeholders throughout the Northeast involved with this commodity group. The continued development of this system will enhance the future integration of pest management information and tactics such as digitally based decision trees, computer models of pest development and management strategies, and sampling and monitoring systems with PMEP's database of pesticide information. The model system proposed for development in this project can eventually be expanded to include other commodities produced in NY and surrounding states. The information management techniques developed for producing the Tree Fruit IPM Guidelines will also be used in the production of the national portal for wildlife damage management for the Extension system. This cross fertilization of information management techniques will make it possible for the IPM Guidelines to be used in the next generation of content projects for the eXtension system.

c. Approach and Procedure

This project will change the Tree Fruit IPM Guidelines from a print publication to a digital application. The general format of this website will be similar in theme to that of the web-based Washington State Decision Aid System that was funded by the Washington State Tree Fruit Commission (<http://das.wsu.edu/modelDisplay7A.php>). This site allows growers and other users to select a category of tree fruits (apples, pears, and cherries) and weather stations in locations that are appropriate for their activities. After the users have created their personal profile, they have access to pest development models that provide information about types and timing of management tactics, and predicted pest development for the following week based on average seasonal weather conditions. Management tactics are recommended based on model predictions. When pesticides are recommended, the site provides a link to information in the Washington State University (WSU) spray guide, which includes the following categories of information: Common name, trade name, rate, Re-entry interval, Pre-harvest interval, Efficacy against various pests, bee toxicity, impacts on natural enemies, general comments, and use restrictions.

Creating digital materials requires a different paradigm for work and production. Style is separated from content and content needs to be semantically structured so that it can be used programmatically within and between applications. Software solutions to web collaboration, digital publications and application management vary in ease of use and programmability. Users (extension staff or stakeholders) don't care about ideological adherence to Open Source software or a particular vendor. They want intuitive, exciting, easy to use software.

Using Word documents mimics the pen and paper process of creating content. To evolve from creating a publication to creating a digital application, a much higher level of semantic structure is required. Content must be standardized and organized. It is unrealistic to assume that authors can create this type of data organization without help. If a pesticide profile in one publication has the active ingredient listed, then active ingredients should be listed in the same format for all pesticide profiles across publications so that users can create a query to retrieve that information. These kinds of highly structured documents are beyond what authors alone would be expected to create.

In this project, XML-based schemas of pest information will be created. We will create XML documents, interchangeable with SQL database tables for all of the pests in the Cornell IPM Guidelines. These pest profiles will contain similar types of data for common insects, diseases, weeds, molds, fungi, nematodes, and vertebrate pests. The XML schemas will provide a variety of functions and purposes. They will serve as the basis to semantically structure content, allow the interchange of content with other systems, and facilitate building a content repository for publishing on the web and for print.

Pesticide profiles will be created that delineate key information about a pesticide, effects on natural enemies, environmental safety, toxicity to humans and vertebrates, and compatibility with IPM programs. Profiles on hosts (commodity crops) and host environments will be developed so that pest and pesticide profiles can be linked to hosts and pest environments. To complete the data sets we need to produce the Guidelines, we will create schemas to capture information about authors, editors and reviewers, and additional resources. This metadata information will follow the national eXtension and Dublin core metadata schema. Utilizing the national eXtension metadata schema makes it possible to organize the content in a way that it can be used by eXtension and following the Dublin core metadata schema makes it possible for the content to be searchable by electronic catalogs.

To connect the pest profiles and pesticide information to IPM practices, we will create a schema that systematizes IPM strategies. Particular strategies can be linked within the schema. Checklists, best practices and other IPM materials can all be linked to both pests and hosts so that a robust IPM strategy is suggested when a user queries for a pest.

The other common and important data elements that need to be semantically structured include basic information on plant nutrition, soil science, climate information (not specific data but approaches to using climate data), and other information common to the Guidelines. Critically important is the necessity to create common sections of information on pesticide safety, regionalized legislative information, pesticide application techniques and technology, and pesticide stewardship. All of the elements in each of the schemas will be peer reviewed to make certain that the elements create a superset of information that should be collected and organized to create effective IPM Guidelines or pest solutions.

Given the vast amount of resources already available on the Internet, our schema design will include fields for cross referencing other information, either within the Guidelines or on the Internet. We will be soliciting the “best” URLs for IPM information, crops and climate information, pest databases, and much other information that is outside the scope of the Cornell IPM Guidelines. A selection of web based resources will be returned in the dataset of a pest or pesticide profile.

The XML schemas will allow us to develop forms that can be used in a collaborative web environment to create, review, update and manipulate the data. We will also create MS Word documents based on the XML schemas that authors can use if they are uncomfortable with a web environment. It is unrealistic to expect authors to learn how to use a wiki, master a content management system or create schemas. It is important to make the barrier to content creation and author participation as low as possible to facilitate staff engagement and to create an efficient system both technically and administratively. Much of our time in administering the Guidelines is monitoring and reminding authors that they need to complete content they agreed to create. We must simplify the process and make it possible for any author to participate regardless of their level of technology skill.

Version 3.0 of Microsoft SharePoint collaborative software, an industry standard in the corporate world, will be used to create the collaborative authoring and social networking environment. SharePoint provides an easy to use, robust, content management system complete with programmable workflows, task management, and many other social networking features. It is easy to program against the SharePoint shell using MS .net technologies. Microsoft has heavily invested in making tools available for the control of corporate information, which more closely follows the hierarchal flow of academic information. These server based tools are less often used in academic environments given a penchant for using open source software. The XML schemas will be developed using popular XML editing tools and will be fully compliant with open source applications. The primary goal of this project is to make it easier for authors to create IPM materials and distribute them to as large and audience as possible.

During the initial phase of this project, a prototype website will be developed. Plant pathologists and entomologists will develop improved interactive outputs for on-line models for key insect pests and diseases. NEWA will program this information into the forecast models. The IT (Information Technology) specialist will then program this information into the website. New models for future web-posting will be identified. Display output templates will be developed for pesticide selection recommendations for each pest at various times throughout the season. Plant pathologists and entomologists will work with the IT specialist to develop a display template to standardize the types of information that will be presented for each pesticide to enhance choices by users. Links to other appropriate IPM information sources will be added to website (fact sheets, monitoring and sampling information, pesticide safety, application technology & drift control, etc.) Appropriate links for the website will be solicited from the group of collaborators, producers, agribusiness consultants, and CCE Educators involved in this project.

The prototype website will be tested initially by the collaborators during the 2009 growing season. A training school will be held during the early spring at Cornell to instruct users in the proper use and outputs generated by the website and a preliminary print/and online User’s Manual will be prepared. Producers will select key blocks or whole farms on which certain pests/diseases will be managed according to website information. Consultants will provide information from the website on managing these pests/diseases to all or a subset of their clients. CCE educators will use this website and transmit appropriate information to growers throughout the season in their periodic newsletters. After the growing season a survey will be presented to all collaborators to evaluate the current contents of the website and suggest modifications for future use. During the winter of 2009, the website will be modified and the modified website will be evaluated by the collaborators again during the 2010 growing season. At the end of 2010, the website will be modified and made accessible to all members of the NY and New England Fruit industry and publicized during the winter at New England and New York regional tree fruit meetings and at the NY Fruit & Vegetable Expo. After the website is released to the industry, SharePoint technologies will be used to interactively gather stakeholder input by using discussion boards, surveys, and other online tools. Stakeholders from NY and throughout New England will be invited to participate by email, telephone, or by print notification. These concerns and needs will be addressed and used to make the Tree Fruit Guidelines a more effective IPM tool in the future.

Project Timetable

	Internal team	External outreach
Phase One Sep 1 '08 to Feb 28 '09	Design the general format of the website and develop schemas and templates Program outputs and prepare display templates for pest development models. Develop display templates for pesticides and select appropriate links for additional IPM decision information. Select and list potential appropriate links for the website and solicit priority ranking of links and suggestions from the advisory committee of growers, consultants, and CCE Educators.	Develop collaborative web site for author participation in NY and New England. Conduct training school to familiarize collaborators with the prototype website.
Phase Two Mar 1 '09 to Aug 31 '09	Collaborators in NY and NE will test the website throughout the growing season	Initially the website will be used by collaborators on a limited amount of acreage (1000-500-acres). Model predictions and decision information will be distributed to clients of agribusiness consultants, and through CCE newsletters to

		other growers.
Phase Three Sep 1 '09 to Feb 28 '10	Modify the website according to comments and suggestions from stakeholders and collaborators.	Collaborators will be surveyed to solicit changes and modifications to website.
Phase Four Mar 1 '10 to Aug 31 '10	Collaborators in NY and NE will test the website during the second growing season.	At the end of the growing season, the website will be modified and released to the entire fruit industry in NY and New England

d. Evaluation Plan

At the end of each growing season, surveys will be designed to monitor the collaborators use patterns and satisfaction with the web design and outputs. Suggestions for modification and improvement will be collected and used to redesign the website. The cost of designing the survey and analysis of results is included in the salaries of the CU IT specialist. Grower collaborators will designate either their whole farm or certain blocks that they will manage throughout the season using website recommendations during both the 2009 and 2010 growing seasons. Private consultants will select a representative group of blocks or their clients' farms that will be managed using website recommendations. At the end of the season, the PI's will estimate harvest damage from blocks managed using website recommendations and collect pesticide records. Pesticide use, costs, and harvest damage from blocks using website recommendations will be compared to a representative group of similar blocks managed by standard grower's practices.

5. Key Personnel

Apple Producers-Walter Blackler, Eric Brown, Richard Endres, McIntosh Forrence, Donald Green, Christopher Hance, Oded Kalir, Stephen Knapp, Mike Maloney, Darryl Oakes, Mark Russell, Peter Russell, Thomas Staples, Peter Tenyck, William Truncali, Maurice Tougas, William Broderick, Thomas Clark, Aaron Clark, Franklin Carlson-will test the website and use information to make decisions on their farms. After the growing season, producers will be surveyed and information will be used to redesign website.

CCE Personnel-Deborah Breth, Lake Ontario Fruit Program; Michael Fargione, CCE Ulster County; Kevin Iungerman, CCE NE NY Fruit Program-will test the website and transmit information in newsletters to growers throughout the season.

Department of Natural Resources, Cornell University: Raj Smith, Academic Consultant & Web Programmer - will provide support and personnel to create metadata in conjunction with the Wildlife Damage Management extension project under the direction of Paul Curtis. Will also work with W. Parken to create schemas and templates

for the website.

Entomology Department, Cornell University, NYSAES: Arthur Agnello, Professor of Entomology and Coordinator of Tree Fruit Pest Management Guidelines-will assist in preparation of current guidelines in the standard digitized format, and coordinate the presentation of entomological IPM information and insecticides and acaricides recommendations.

NE Reg. Climate Center. ,Department of Atmospheric Science Cornell University- Art DeGaetano's programming staff will reprogram NEWA pest forecast models formats and output to fit into the Guidelines website.

New England Land Grant Collaborators: Lorraine Berkett, Plant and Soil Science, Univ. of Vermont; Jon Clements, Univ. of Mass. Extension; Daniel Cooley, Dept. Plant, Soil, Insect Sci, Univ. of Mass.; Heather Faubert, Plant Science Dept, University of Rhode Island; Glen Koehler, Pest Management Office, University of Maine; Lorraine Los, Dept Plant Science, Univ. of Conn-will provide input and assist in revision of current Tree Fruit Guidelines to customize the data to be appropriate to their specific locations. This group will oversee the establishment of the Tree Fruit IPM Guidelines on each university Website.

NYS IPM Program: Juliet Carroll, Fruit IPM Coordinator-will provide support by providing access to IPM content resources that can be used to enhance the Tree Fruit Guidelines. The IPM program will also help to formulate models and checklists of effective IPM decision making steps. She will also work with the NEWA program to coordinate model output from the various subject matter specialists.

Pesticide Management Education Program: Harvey Reissig, Director; William Smith, Senior Extension Associate; Ronald Gardner, Senior Research Associate; Michael Helms, Extension Support Specialist-will provide the overall leadership and coordination of the project. The program personnel will interact with collaborators from other units or institutions to facilitate their input and coordination of data. They will oversee the preparation and organization of the data into printed Guidelines and web presentations.

Plant Pathology Department, Cornell University, NYSAES: Kerik Cox, Assistant Professor of Plant Pathology-will assist in preparation of current guidelines in the standard digitized format, and coordinate the presentation of IPM information and pesticide recommendations for management of plant diseases. He will also work with improving the design and output for computer models of plant diseases on the website.

Relevance Statement

a. PD's and Major Cooperators

W. H. Reissig, Department of Entomology, Cornell University

D. R. Cooley, Department Plant, Insect & Soil Science, University of Massachusetts

J. Clements, Extension Tree Fruit Specialist, University of Massachusetts.

b. Project Title

Development of Enhanced, Web-based New York and New England Tree Fruit Pest Management Guidelines

c. Project Type:

Extension

d. Project Summary

Cornell's Pest Management Guidelines for Tree Fruit Production have traditionally been a primary information source for producers. Printed guidelines cannot deliver IPM information in "real time" during the season. Web-based IPM sites that have access to weather data can provide pest development forecasts so that pest populations can be sampled and monitored at appropriate times and insure that pesticide applications and other control tactics are properly timed. Websites can also help growers choose the most appropriate pesticide when necessary. Most of this information is currently available on various Cornell websites or in the printed guidelines, but it is scattered among different sources. This project will integrate all of this information into a single user-friendly website. Users will be able to access pest forecast models linked to weather conditions at particular sites that will predict when sampling and monitoring is necessary and provide information about different management tactics. When pesticides are recommended, the site will provide a link to a pesticide decision table which includes the following categories of information to help users choose the most appropriate material: Common name, trade name, rate, Re-entry interval, Pre-harvest interval, Efficacy against various pests, bee toxicity, effects on natural enemies, cost/acre, general comments and use restrictions.

e. Description of Problem, Background and Justification

Cornell University has published printed Pest Management Guidelines for Tree Fruit Production that have been used by producers, CCE Educators, and consultants for many years. It is becoming increasingly difficult for Cornell to generate and deliver this information to the fruit industry because fewer Cornell staff are being hired to conduct

applied research and resources for extension personnel are diminishing each year. Printed guidelines are unable to deliver IPM information in “real time” during the season. Web-based IPM sites, such as NEWA, that have access to weather information for different production sites can provide pest development forecasts so that populations can be sampled and monitored at appropriate times and insure that pesticide applications and other control tactics are timed according to seasonal pest development. Websites, such as PMP Guidelines, can provide information for choosing pesticides based on efficacy against the target pest, other secondary pests, environmental effects, IPM considerations, and cost. Most of this information is currently available on various Cornell websites or in the printed guidelines. However, it is difficult for users to integrate it into a comprehensive management system that can be used to make pest control decisions at appropriate times throughout the season. This project will integrate all of this information together in a website format that can easily be used by the apple industry.

The format of this website will be similar in theme to that of the web-based Washington State Decision Aid System that was funded by the Washington State Tree Fruit Commission (<http://das.wsu.edu/modelDisplay7A.php>). This site allows growers and other users to select a category of tree fruits (apples, pears, and cherries) and weather stations in locations that are appropriate for their activities. After the users have created their personal profile, they have access to pest development models that provide information about types and timing of management tactics, and predicted pest development for the following week based on average seasonal weather conditions. Management tactics are recommended based on model predictions. When pesticides are recommended, the site provides a link to information in the WSU spray guide, which includes the following categories of information: Common name, trade name, rate, Re-entry interval, Pre-harvest interval, Efficacy against various pests, bee toxicity, impacts on natural enemies, general comments, and use restrictions. During the initial phase of this project, a similar prototype website will be developed. This site will be tested by a representative advisory group of growers, extension personnel, and private consultants during two growing seasons. The website will be modified at the end of each growing season using input from the advisory user’s group. At the end of this project the Guidelines website will be made available to the entire tree fruit industry in NY. This Guidelines website can serve as a model system for the future development of similar sites for other commodity groups.

f. Project Objectives and Anticipated Outcomes

The objective of this project is to design a website for New York and New England Tree Fruit Pest Management Guidelines that will allow the industry to integrate information from pest development models, IPM tactics, and pesticide information into a comprehensive management system that can be used to make pest control decisions at appropriate times throughout the season. The organization and design of web-based tree fruit information that can be customized according to regional needs will immediately impact stakeholders throughout the Northeast involved with this commodity group. The model system proposed for development in this project can eventually be expanded to

include other commodities produced in NY and surrounding states. The information management techniques developed for producing the IPM Guidelines will also be used in the production of the national portal for wildlife damage management for extension system. This cross fertilization of information management techniques will make it possible for the IPM Guidelines to be used in the next generation of content projects for the eXtension system.

Multistate Partnership-This project will be a partnership between Cornell University in NY and Universities in the major tree fruit production regions in New England, Maine, Massachusetts, Connecticut, Vermont, and New Hampshire.

Stakeholder support and priority-The IPM Statewide Grower Advisory Committee unanimously voiced the need for easy-access to information on pesticide selection, safety, environmental fate and risk as a priority for producers in New York to facilitate sustainable, low-impact, low risk pesticide choices. A recent survey of growers that use the NYS IPM Network for Environment and Weather Awareness (NEWA) found that NEWA pest forecasts help them reduce the number of sprays applied to control pests, improve the timing of pesticide applications, alert them to the risk of pest damage, and enhance their IPM decision-making. Apple growers make up the largest group of producers that utilize NEWA regularly. (from Terence Robinson's Statewide Fruit Extension grant)... "The lack of adoption of crop development and pest protective modeling systems hamper optimal production decisions. This also compromises low impact pesticide practices, and lessens preparedness to damaging natural events, such as disease infection periods and pest infestations."

Underserved target audience-New England Tree Fruit growers typically have small farms < 40 acres, and shrinking University resources have depleted extension personnel that deal with **producers of these crops**.

Regionality of crop and economic importance-Apples are an important crop in New York and the NE region. There are approximately 1000 apple growers generating \$194 million in farm gate value and \$750 million in retail fruit sales in NY, which ranks second or third annually in national production. The NE region ranks seventh in national apple production with 16,500 acres of apples producing a farm gate value of 45.8 million dollars.

Interdisciplinary Nature-Tree Fruit IPM Guidelines integrates subject material from a large number of scientists dealing with pesticide information, entomology, plant pathology, horticulture, soil science, weed management, wildlife management, and plant nutrient management.

Progress toward sustainability-This project will provide the apple industry with a web-based source of information to facilitate the adoption of a comprehensive IPM based philosophy rather than relying on standard pesticide solutions. Users will receive information that will help them determine when and if pesticides are necessary, and help them choose products that are more IPM compatible and safer for the environment. This will facilitate the adoption of more sustainable integrated pest management systems by tree fruit growers throughout the Northeast region.